**Dipartimento di Politiche Pubbliche e Scelte Collettive – POLIS**
Department of Public Policy and Public Choice – POLIS

**Working paper n. 85**

**January 2007**

# The dynamics of art prices: The selection corrected repeat-sales index

**Roberto Zanola**

**UNIVERSITA' DEL PIEMONTE ORIENTALE "*Amedeo Avogadro*" ALESSANDRIA**

*Periodico mensile on-line "POLIS Working Papers" - Iscrizione n.591 del 12/05/2006 - Tribunale di Alessandria*

# The Dynamics of Art Prices: The Selection Corrected Repeat-Sales Index


Roberto Zanola*

Department of Public Policy and Public Choice

University of Eastern Piedmont, Italy


January 8, 2007


**Abstract**

The repeat-sales model controls quality by utilizing the transacted prices of the same items in different time periods. However, this methodology suffers from non-randomness of the data, implying that a sample based only on repeat-sales items may not represent the population of properties. To address this potential problem, the Heckman two-stage procedure has been applied to a sample of Picasso prints over the period 1988-1995 as registered in the 1995 edition of the Mayer International Auction Records on CD-ROM. Empirical evidence shows that the selection corrected repeat-sales model yields substantially better goodness of fit than the estimated standard repeat-sales specification.



JEL Classification: C5, Z1.

Key Words: sample selection; Picasso; repeat sales; prints; price index.


---


*This paper has benefited from comments by Antonello E. Scorcu. The usual disclaimer applies.


E-mail: roberto.zanola@unipmn.it

# 1 Introduction

The repeat-sales model controls quality by utilizing the transacted prices of the same property in different time periods [Bailey et al., 1963; Ashenfelter and Graddy, 2003]. Provided that property characteristics and the relative price structure do not change between sales, the price differences can be solely explained by time dummies. Although the method avoids the difficulty of explicitly specifying the relevant quality characteristics, such as the case for hedonic approach, it does so at the cost of ignoring all information on single transactions. An attempt to use all the information by jointly estimating conventional hedonic and repeat sales models is to combine sale and repeat sales in a system of equations [Case and Quigley, 1991; Carter Hill et al., 1997; Locatelli and Zanola, 2005]. This methodology encompasses previous techniques since it combines information on repeat sales with hedonic approach, which allows to capture either the increase and/or the depreciation of prices within the repeat sales model and the serial correlation in hedonic data. However, this methodology does not allow to take into account the sample selection bias which arises in focusing on repeat sales only. In fact, repeat-sales indexes suffer from non-randomness of the data, implying that a sample based only on repeat-sales items may not represent the population of properties.

To address the potential problem of sample selection bias, in this paper I apply the Heckman two-stage procedure to a sample of Picasso prints over the period 1988-1995 as registered in the 1995 edition of the Mayer International Auction Records on CD-ROM. The procedure calls for the estimation of a probit model predicting whether an item is a repeat-sales item or is sold only one time within the analyzed period. Probit estimates are used to construct the inverse Mills ratio, which is used as an explanatory variable into the estimation of the repeat sales equation in order to obtain consistent estimates and provide a test for the presence of sample-selection bias. Hence, data on single and repeat-sales have been used for the construction of the price index as a whole, rather than restricted to the transactions which actually occur twice.

The rest of the paper is organized as follows. Section 2 illustrates the theoretical model. The dataset is described in Section 3. Results are presented in Section 4. Section 5 concludes.

# 2 The Model

The repeat-sales index method, initially proposed by Bailey et al. (1963), follows the changes in value of re-sold prints. It provides an alternative estimation method to hedonic price index method based on price changes of prints sold more than once. In fact, repeat-sales methods have been developed to abstract from measuring the hedonic characteristics of items. More generally, the repeat-sales method can be viewed as an extension of the explicit inter-temporal model when the same art item is observed to be sold more than once.

Assuming the characteristics and the implicit prices of the same print do not change between the first sale and the second sale, the price difference between two sales of the same print may be expressed as:

$$p_{it+s} - p_{it} = \sum_{t=1}^{T} \beta_t D_{it} + (\varepsilon_{it+s} - \varepsilon_{it}) \tag{1}$$

where $p_{it}$ denotes the sales price of print $i$ in period $t$. with $t + s > t$; $\beta_t$ is a parameter; $D_{it}$ is a set of time dummy variables equal to $-1$ in period, $+1$ in period $t+s$, zero otherwise; and $\varepsilon_{it}$ is the random error term, which is normally distributed.

When the assumption of unchanged print characteristics is not violated, as it is in this case, the advantage of the repeat-sales method is that such characteristics do not need to be estimated in order to calculate an art price index. However, it drives several disadvantages, including the non-randomness of the sample, reductions in sample size, selectivity, non-applicability to a single cross-sectional comparisons [Haurin and Hendershott, 1991].

Attempts at solving these problems focus on hybrid models, which combine information on repeat sale with hedonic approach [Case and Quigley, 1991; Carter Hill et al., 1997; Locatelli and Zanola, 2005]. However, also this methodology fails to directly solve the sample selection problem. In particular, in the case of repeat-sales model a double selection problem emerges. First, with infrequent repeat sales, the sample sizes is quite small and it does not represent the population of properties. Secondly, selection bias may also arise when second sales bring previously omitted first-sale data into the sample.

To address the double selection bias, the Heckmann (1974, 1979) two-step procedure for correcting for sample selection bias derived by is integrated for constructing an unbiased price index when items are sold twice [Gatzlaff and Haurin, 1997; Hwang and Quigley, 2004]. Following Heckman (1979), the first step of the procedure calls for the estimation of a probit model predicting whether an art item is sold twice or not. Let $I_{it}$ be an indicator variable which takes the value of 1 if the print $i$ is sold at time $t$ and zero otherwise, and let:

$$prob\left(I_{it}=1\right)=\Phi\left(\gamma_0+\sum_{m=1}^{M}\gamma_m Z_{mit}\right) \tag{2}$$

where $\Phi$ is the standard normal distribution; $Z_{mit}$ are the relevant hedonic characteristics $(m=1.\ldots.M)$ of the print $i$ at time $t$; and $\gamma$ is a set of parameters. In the second step, the inverse Mills ratio, $\lambda_{it}=\phi\left(\gamma Z_{it}\right)/\Phi\left(\gamma Z_{it}\right)$, where $\phi$ is the standard normal density, is included as independent variable in equation (1) to yield unbiased price index, thereby correcting for the non-randomness of sample selection:

$$p_{it+s}-p_{it}=\sum_{t=1}^{T}\beta_t D_{it}+\chi\left(\lambda_{it+s}-\lambda_{it}\right)+\left(\varepsilon_{it+s}-\varepsilon_{it}\right) \tag{3}$$

where $\chi$ is a parameter to be estimated.

# 3 Data

Data is drawn from auctions held during the period 1987-1995 as reported in the 1995 edition of the *Mayer International Auction Records* on CD-Rom, which contains records of Picasso prints sold at the world's major auctions. As noted by Pesando and Shum (1996), due to the homogeneous quality and condition of the impressions I only focus on Picasso prints, which also closely resemble price movements in the market for modern prints as a whole. Each print is described by a number of characteristics. Prices are gross of the buyers and sellers' transaction fees paid to auction prints and are recorded in both local currency and US dollars. This last (US) currency has been used for performing estimates. Sales are assumed to occur at the end of each period.

The Probit model is estimated with a total of 1,665 Picasso prints. To this aim, the physical variables include the surface of the print, *dim*, as well as the squared surface, *dim*2; the total number of copies produced of the same print, $n\_print$; a dummy variable to take into account if prints are signed, *sign*, with value of 1 if prints are signed, and 0 otherwise; a dummy variable is introduced to take into account if prints are coloured, *colour*, with value of 1 if prints have more than one color, and 0 otherwise; a set of dummy variables, reflecting the technique adopted: etching, *etch*; litho, *litho* (excluded variable); drypoint, *dry*; aquatint or eau-forte, *aqua*; linocut, *lino*; and all other media, *other*.

For the purpose of this study, auction houses where prints are sold must be also included as the relevant characteristics of $i$-prints. Sotheby's and Christie's are known to be the leading auction houses in this kind of transaction while the most important art auction markets are New York and London. In order to depict precisely the geographical structure of both the market and the auction house, I consider some city and auction house pairs. In particular, several dummies are taken into account as follows: *sothny*, for Sotheby's New York; *sothlon*, for Sotheby's London; *chriny*, for Christie's New York; *chrilon*, for Christie's London; *francall*, for print sold in France; *germany*, for prints sold in Germany; *otherus*, for prints sold in US but not in New York; *othereu*, for prints sold in the European countries not mentioned before; *world*, all other salerooms and cities of sales; *swiss*, for prints sold in Switzerland (excluded variable).

Finally, a set of dummy variables, $D_t$, with $t = 1988, ......, 1995$, are introduced for each semester between 1988:I and 1995:II (with 1988:I excluded). Clearly, the meaning of time dummies is different for single and repeat sales. In the case of single sales, the dummy variables are $+1$ if the sale occurs that semester, zero otherwise. In the case of repeat sales the dummy variables are $-1$ at the time of the first sale of the asset; $+1$ at time of the second sale of the asset; and zero otherwise. Table 1 describes the main features of the dataset.

[TABLE 1]

Sales which are one of a repeat-sales pair accounts for 174 sales; this constitutes the 10.45 per cent of the total sample, which is consistent with similar studies on repeat-sales items [Case and Szymanoski, 1995; Munneke and Slade, 2000; Hwang and Quigley, 2004]. As usual for the repeat-sales sub-samples, inspection of Table 1 reveals some substantial differences between the characteristics of the total sample versus the characteristics of the data having sold twice.

# 4 Results

In this section, the results from the repeat-sales models described in Section 2 are compared. The probit model relates whether a print is sold twice to a number of characteristics.

[TABLE 2]

As reported in Table 2, the probability of sales of a print in any semester interval differs for prints with different characteristics. A number of coefficients are statistically significative, a heartening result in view of what might be regarded as the foolhardy strategy of including such a large array of variables (Steele and Goy, 1997).

In any case, the primary concern is not with coefficients of characteristics; but rather with the estimation of the inverse Mills ratio of both the first and the second sale to be used in equation (3). Two alternative semi-annual repeat-sales index estimates are reported in Table 3: the standard repeat-sales index, and the selection corrected repeat-sales index based on equation (1) and (3), respectively.

[TABLE 3]

Columns (1) and (2) present respectively the coefficients and the standard deviations for the standard repeat-sales index. The standard repeat-sales index, to be used as benchmark, uses information from only the sold properties and it does not control for selection bias. Columns (3) and (4) show the results of the selected repeat sales method. The selection corrected repeat-sales model is constructed from the estimation of equation (3) and includes in the estimation $\lambda_{it}$ and $\lambda_{it+s}$.

The Wald test assumption of the null of all coefficients in the regression (except the constant) being 0 is rejected. Furthermore, the likelihood-ratio test is also computed. It compares the joint likelihood of an independent probit model for the selection equation and a regression model on the observed hammer price data against the Heckman model likelihood. The $z = -1.56$ and $\chi^2$ of 2.44 are different from zero, justify the Heckman selection equation with this data.

We are now in the position to evaluate the selection corrected repeat-sales index. A common way of comparing the goodness of fit of two or more econometric models for the same dependent variable is to compare the estimated standard deviation of the disturbance term. This is a direct measure of the degree of variation in the dependent variable not explained by the econometric model: the smaller estimated standard deviation of disturbance is, the better the explanatory power of the model. Table 4 compares the estimated standard deviation of the disturbance terms. The selection corrected repeat-sales model yields substantially smaller estimate of the estimated standard deviation of the repeat-sales specification.

[TABLE 4]

A second measure used to compare hammer price models is the width of the confidence interval around the predicted price of an average print. It reflects the precision with which the individual parameters of the model are estimated using a specific econometric model. In particular, since the width is closely related to the estimated standard deviation of the estimated parameters, it follows that the corrected repeat-sales model is expected to have smaller confidence interval than corresponding repeat-sales model. Table 5 display the width of a 95 percent confidence interval estimated around the predicted price of a representative print. Results show the same patterns observed for the estimated standard deviation of the disturbance term. Specifically, the corrected repeat-sales model is more precise than the repeat-sales model yielding a narrow confidence interval than the repeat-sales model.

[TABLE 5]

Finally, a third measure used to assess the relative precision of each hammer price models is the correlation between the actual and predicted values of all properties included in the dataset. It provides a direct measure of the reliability with which the price of each print can be predicted from the econometric model [Case and Szymanoski, 1995]. Again, the corrected repeat-sales model displays a higher correlation value (0.64) than the repeat-sales model (0.62).

# 5 Conclusions

This paper suggests and tests a methodology to solve the non-randomness of the data which biases the repeat-sales hammer price indexes. To correct for this type of sample selection bias requires application of a two-step procedure for correcting for sample selection bias derived by Heckmann, the so-called selection corrected repeat-sales index. Estimates of the first-stage sample selection equation show that the likelihood of sale is influenced by a number of hedonic characteristics. Second-stage estimates of the hammer price index equation reveal the significance of the potential bias. In particular, using a sample of Picasso prints sold at auctions during the period 1987-1995, I find that the selection corrected repeat-sales model yields substantially better goodness of fit than the estimated standard repeat-sales specification.

# References


[1] Ashenfelter, O., Graddy, K. (2003), Auctions and the price of art, *Journal of Economic Literature*, 41(3), 763-787.

[2] Bailey, M.H., Muth, R.F., Nourse, H.O. (1963), A Regression Method for Real Estate Price Index Construction, *Journal of the American Statistical Association*, 4, 933-942.

[3] Carter Hill, R., Knight, J.R., Sirmans, C.F. (1997), Estimating Capital Asset Price Indexes, *The Review of Economics and Statistics,* 79, 226-233.

[4] Case, K.E., Quigley, J.M. (1991), The Dynamics of Real Estate Prices, *Review of Economics and Statistics*, 73(1), 50-58.

[5] Case, B., Szymanoski, E. J. (1995), Precision in House Price Indices: Findings of a Comparative Study of House Price Index Methods, *Journal of Housing Research*, 6, 483-496.

[6] Gatzlaff, D.H., Haurin, D.R. (1997), Sample Selection Bias in Local House Value Indices, *Journal of Urban Economics,* 43(2), 199-222.

[7] Haurin, D., Hendershott, P. (1991), House Price Indexes: Issue and Results, *AREUEA Journal*, 19(3), 259-269.

[8] Heckman, J. (1979), Sample Selectivity Bias as Specification Error, *Econometrica*, 47(1), 153-161.

[9] Heckmann, J. (1974), Shadow Prices, Market Wages, and Labor Supply, *Econometrica*, 42, 679-694.

[10] Hwang, M., Quigley, J.M. (2004), Selectivity. quality Adjustment and Mean Reversion in the Measurement of House Values, *Journal of Real Estate, Finance and Economics*, 28 (2/3), 161-178.

[11] Locatelli, M., Zanola, R. (2005), The Market for Paintings: An Hybrid Model Approach, *Journal of Cultural Economics*, 3, 127-136.

[12] Munneke, H.J., Slade, B.A. (2000), An Empirical Study of Sample-Selection Bias in Indices of commercial Real Estate, *Journal of Real Estate, Finance and Economics*, 21(1), 45-64.

[13] Steel, M., Goy, R. (1997), Short Holds, the Distributions of First and Second Sales, and Bias in the Repeat-Sales Price Index, *Journal of Real Estate, Finance and Economics,* 14, 133-154.

**TABLE 1. Descriptive Statistics 1988-1995**

| Variable | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|
| | ***A. Single Sales (N = 1665)*** | | | |
| price (in $) | 19925.78 | 45974.64 | 200.00 | 940.000.00 |
| dim | 1.855.44 | 1.635.92 | 36.40 | 31.520.31 |
| n_print | 90.60 | 103.09 | 2.00 | 1000 |
| sig | 0.84 | 0.37 | 0.00 | 1.00 |
| colour | 0.21 | 0.41 | 0.00 | 1.00 |
| etch | 0.38 | 0.48 | 0.00 | 1.00 |
| dry | 0.09 | 0.29 | 0.00 | 1.00 |
| aqua | 0.07 | 0.25 | 0.00 | 1.00 |
| lino | 0.18 | 0.38 | 0.00 | 1.00 |
| other | 0.02 | 0.13 | 0.00 | 1.00 |
| litho | 0.27 | 0.44 | 0.00 | 1.00 |
| sothny | 0.28 | 0.45 | 0.00 | 1.00 |
| sothlon | 0.17 | 0.37 | 0.00 | 1.00 |
| chriny | 0.13 | 0.33 | 0.00 | 1.00 |
| chrilon | 0.11 | 0.32 | 0.00 | 1.00 |
| francall | 0.08 | 0.26 | 0.00 | 1.00 |
| germany | 0.07 | 0.25 | 0.00 | 1.00 |
| otherus | 0.04 | 0.20 | 0.00 | 1.00 |
| othereu | 0.03 | 0.17 | 0.00 | 1.00 |
| world | 0.02 | 0.15 | 0.00 | 1.00 |
| swiss | 0.06 | 0.24 | 0.00 | 1.00 |
| litho | 0.27 | 0.44 | 0.00 | 1.00 |
| D88:I | 0.06 | 0.23 | -1.00 | 1.00 |
| D88:II | 0.08 | 0.26 | -1.00 | 1.00 |
| D89:I | 0.09 | 0.29 | -1.00 | 1.00 |
| D89:II | 0.06 | 0.24 | -1.00 | 1.00 |
| D90:I | 0.11 | 0.32 | -1.00 | 1.00 |
| D90:II | 0.04 | 0.19 | -1.00 | 1.00 |
| D91:I | 0.04 | 0.20 | -1.00 | 1.00 |
| D91:II | 0.02 | 0.14 | -1.00 | 1.00 |
| D92:I | 0.05 | 0.23 | -1.00 | 1.00 |
| D92:II | 0.04 | 0.20 | -1.00 | 1.00 |
| D93:I | 0.07 | 0.26 | -1.00 | 1.00 |
| D93:II | 0.04 | 0.20 | -1.00 | 1.00 |
| D94:I | 0.07 | 0.25 | 0.00 | 1.00 |
| D94:II | 0.08 | 0.27 | -1.00 | 1.00 |
| D95:I | 0.11 | 0.31 | -1.00 | 1.00 |
| D95:II | 0.04 | 0.19 | 0.00 | 1.00 |

***B.Repeat Sales ($N_R$ = 174 =87 Pairs)***

| | | | | |
|---|---|---|---|---|
| $Price_t$ | 47,898.79 | 65,090.39 | 1,600 | 378,790 |
| $Price_{(t+s)}$ | 42,484.71 | 62,546.26 | 2,660 | 340,000 |
| D88:I | -0.10 | 0.31 | -1.00 | 0.00 |
| D88:II | -0.07 | 0.43 | -1.00 | 1.00 |
| D89:I | -0.13 | 0.40 | -1.00 | 1.00 |
| D89:II | -0.01 | 0.42 | -1.00 | 1.00 |
| D90:I | -0.01 | 0.52 | -1.00 | 1.00 |
| D90:II | 0.01 | 0.39 | -1.00 | 1.00 |
| D91:I | 0.06 | 0.49 | -1.00 | 1.00 |
| D91:II | 0.05 | 0.30 | -1.00 | 1.00 |
| D92:I | 0.13 | 0.37 | -1.00 | 1.00 |
| D92:II | 0.02 | 0.21 | -1.00 | 1.00 |
| D93:I | -0.07 | 0.30 | -1.00 | 1.00 |
| D93:II | -0.05 | 0.21 | -1.00 | 0.00 |
| D94:I | 0.02 | 0.15 | 0.00 | 1.00 |
| D94:II | 0.00 | 0.22 | -1.00 | 1.00 |
| D95:I | 0.06 | 0.32 | -1.00 | 1.00 |
| D95:II | 0.09 | 0.29 | 0.00 | 1.00 |

**TABLE 2. Probit model of probability of sale in any semester 1988-1995**

| Variable | Coefficient | Std. Err. |
|---|---|---|
| dim | -0.0001877 | 0.0000712 |
| dim2 | 7.59e-09 | 2.49e-09 |
| n_print | -0.0000852 | 0.0007144 |
| sig | -0.564836 | 0.1536888 |
| colour | 0.5053757 | 0.1990067 |
| etch | -0.1771685 | 0.1778357 |
| dry | -0.9051219 | 0.3164198 |
| aqua | -0.1253712 | 0.23781 |
| lino | -0.8295855 | 0.2609411 |
| other | -0.3521777 | 0.385609 |
| sothny | -0.368279 | 0.2233228 |
| sothlon | -0.2922498 | 0.2424772 |
| chriny | -0.3374871 | 0.2490545 |
| chrilon | -0.5255215 | 0.3212364 |
| francall | 0.6527007 | 0.2433742 |
| germany | -0.6212671 | 0.2989248 |
| otherus | 0.2939351 | 0.2826532 |
| othereu | -0.2978218 | 0.3683248 |
| world | -0.1663604 | 0.4143306 |

*Notes*. The model also contains time dummy variables for each semester from 1988:I through 1995:II. Results are computated on 1.665 Picasso prints. */**/*** significance at 1%. 5%. 10%. respectively.

**TABLE 3. Alternative repeat-sales price indexes for Picasso prints**

| | Repeat-sales Price Model | | Selection Corrected Repeat-Sales Price Model | |
|---|---|---|---|---|
| **Variable** | **Coef.** | **Rob. Std. Err.** | **Coef.** | **Rob. Std. Err.** |
| D88:II | 0.1323445 | 0.1733751 | 0.2013921 | 0.1275404 |
| D89:I | 0.2491968 | 0.2119746 | 0.3347066 | 0.1731244 |
| D89:II | 0.6709973* | 0.2049776 | 0.7923346 | 0.1727835 |
| D90:I | 0.5014519* | 0.2019792 | 0.6959125 | 0.2244966 |
| D90:II | 0.4805644** | 0.2152113 | 0.7074705 | 0.2930297 |
| D91:I | 0.3860939*** | 0.2065482 | 0.6265385 | 0.2362956 |
| D91:II | 0.3512677 | 0.2628176 | 0.67828 | 0.3865739 |
| D92:I | -0.1803018 | 0.2046352 | 0.1056281 | 0.2598114 |
| D92:II | -0.1962179 | 0.325501 | 0.2262526 | 0.4020587 |
| D93:I | -0.6282793*** | 0.3334847 | -0.2683778 | 0.3510804 |
| D93:II | -0.8803559** | 0.4372302 | -0.5135032 | 0.4010293 |
| D94:I | -0.6466308 | 0.4913997 | -0.1363724 | 0.4434488 |
| D94:II | -0.4171771 | 0.3464526 | -0.0280528 | 0.340588 |
| D95:I | -0.5911461** | 0.2990719 | -0.129798 | 0.3889912 |
| D95:II | -0.7359309** | 0.3664381 | -0.2046299 | 0.4490041 |

| | | |
|---|---|---|
| Wald chi2(15) | 115.74 | Prob > chi2 = 0.0000 |
| Likelihood-ratio test | 2.25 | Prob > chi2 = 0.1333 |

*Notes*. */**/*** significance at 1%. 5%. 10%. respectively.

**TABLE 4. Results for Estimated Standard Deviation of the Disturbance Term**

| Repeat-sales Price Index | | Selection Corrected Repeat-Sales Price Index | |
|---|---|---|---|
| **Mean** | **Std. Dev.** | **Coefficient** | **Std. Dev.** |
| 0.1942031 | 0.0525362 | 0.1770209 | 0.0507846 |

**TABLE 5. Results for Width of the Confidence Interval**

| Repeat-sales Price Index | | | Selection Corrected Repeat-Sales Price Index | | |
|---|---|---|---|---|---|
| **Mean** | **Min** | **Max** | **Mean** | **Min** | **Max** |
| -0.0702606 | -1.129731 | 0.6709973 | 0.0321405 | -0.9642903 | 0.7923346 |

## Working Papers

The full text of the working papers is downloadable at http://polis.unipmn.it/

***Economics Series** ****Political Theory Series** **ε Al.Ex Series**

2007 n.85* Roberto Zanola: *The dynamics of art prices: the selection corrected repeat-sales index*

2006 n.84* Antonio Nicita and Giovanni B. Ramello: *Property, liability and market power: the antitrust side of copyright*

2006 n.83* Gianna Lotito: *Dynamic inconsistency and different models of dynamic choice – a review*

2006 n.82** Gabriella Silvestrini: *Le républicanisme genevois au XVIIIe siècle*

2006 n.81* Giorgio Brosio and Roberto Zanola: *Can violence be rational? An empirical analysis of Colombia*

2006 n.80* Franco Cugno and Elisabetta Ottoz: *Static inefficiency of compulsory licensing: Quantity vs. price competition*

2006 n.79* Carla Marchese: *Rewarding the consumer for curbing the evasion of commodity taxes?*

2006 n.78** Joerg Luther: *Percezioni europee della storia costituzionale cinese*

2006 n.77ε Guido Ortona, Stefania Ottone, Ferruccio Ponzano and Francesco Scacciati: *Labour supply in presence of taxation financing public services. An experimental approach.*

2006 n.76* Giovanni B. Ramello and Francesco Silva: *Appropriating signs and meaning: the elusive economics of trademark*

2006 n.75* Nadia Fiorino and Roberto Ricciuti: *Legislature size and government spending in Italian regions: forecasting the effects of a reform*

2006 n.74** Joerg Luther and Corrado Malandrino: *Letture provinciali della costituzione europea*

2006 n.73* Giovanni B. Ramello: *What's in a sign? Trademark law and economic theory*

2006 n.72* Nadia Fiorino and Roberto Ricciuti: *Determinants of direct democracy across Europe*

2006 n.71* Angela Fraschini and Franco Oscultati: *La teoria economica dell'associazionismo tra enti locali*

2006 n.70* Mandana Hajj and Ugo Panizza: *Religion and gender gap, are Muslims different?*

2006 n.69* Ana Maria Loboguerrero and Ugo Panizza: *Inflation and labor market flexibility: the squeaky wheel gets the grease*

2006 n.68* Alejandro Micco, Ugo Panizza and Monica Yañez: *Bank ownership and performance: does politics matter?*

2006 n.67* Alejandro Micco and Ugo Panizza: *Bank ownership and lending behavior*

2006 n.66* Angela Fraschini: *Fiscal federalism in big developing countries: China and India*

2006 n.65* Corrado Malandrino: *La discussione tra Einaudi e Michels sull'economia pura e sul metodo della storia delle dottrine economiche*

2006 n.64$^{\varepsilon}$ Stefania Ottone: *Fairness: a survey*

2006 n.63* Andrea Sisto: *Propensity Score matching: un'applicazione per la creazione di un database integrato ISTAT-Banca d'Italia*

2005 n.62* P. Pellegrino: *La politica sanitaria in Italia: dalla riforma legislativa alla riforma costituzionale*

2005 n.61* Viola Compagnoni: *Analisi dei criteri per la definizione di standard sanitari nazionali*

2005 n.60$^{\varepsilon}$ Guido Ortona, Stefania Ottone and Ferruccio Ponzano: *A simulative assessment of the Italian electoral system*

2005 n.59$^{\varepsilon}$ Guido Ortona and Francesco Scacciati: *Offerta di lavoro in presenza di tassazione: l'approccio sperimentale*

2005 n.58* Stefania Ottone and Ferruccio Ponzano, *An extension of the model of Inequity Aversion by Fehr and Schmidt*

2005 n.57$^{\varepsilon}$ Stefania Ottone, *Transfers and altruistic punishment in Solomon's Game experiments*

2005 n. 56$^{\varepsilon}$ Carla Marchese and Marcello Montefiori, *Mean voting rule and strategical behavior: an experiment*

2005 n.55** Francesco Ingravalle, *La sussidiarietà nei trattati e nelle istituzioni politiche dell'UE*.

2005 n. 54* Rosella Levaggi and Marcello Montefiori, *It takes three to tango: soft budget constraint and cream skimming in the hospital care market*

2005 n.53* Ferruccio Ponzano, *Competition among different levels of government: the re-election problem.*

2005 n.52* Andrea Sisto and Roberto Zanola, *Rationally addicted to cinema and TV? An empirical investigation of Italian consumers*
.

2005 n.51* Luigi Bernardi and Angela Fraschini, *Tax system and tax reforms in India*

2005 n.50* Ferruccio Ponzano, *Optimal provision of public goods under imperfect intergovernmental competition.*

2005 n.49* Franco Amisano e Alberto Cassone, *Proprieta' intellettuale e mercati: il ruolo della tecnologia e conseguenze microeconomiche*

2005 n.48* Tapan Mitra e Fabio Privileggi, *Cantor Type Attractors in Stochastic Growth Models*

2005 n.47[ε] Guido Ortona, *Voting on the Electoral System: an Experiment*

2004 n.46[ε] Stefania Ottone, *Transfers and altruistic Punishments in Third Party Punishment Game Experiments.*

2004 n.45* Daniele Bondonio, *Do business incentives increase employment in declining areas? Mean impacts versus impacts by degrees of economic distress*.

2004 n.44** Joerg Luther, *La valorizzazione del Museo provinciale della battaglia di Marengo: un parere di diritto pubblico*

2004 n.43* Ferruccio Ponzano, *The allocation of the income tax among different levels of government: a theoretical solution*

2004 n.42* Albert Breton e Angela Fraschini*, Intergovernmental equalization grants: some fundamental principles*

2004 n.41* Andrea Sisto, Roberto Zanola, *Rational Addiction to Cinema? A Dynamic Panel Analisis of European Countries*

2004 n.40** Francesco Ingravalle, *Stato, große Politik ed Europa nel pensiero politico di F. W. Nietzsche*

2003 n.39[ε] Marie Edith Bissey, Claudia Canegallo, Guido Ortona and Francesco Scacciati, *Competition vs. cooperation. An experimental inquiry*

2003 n.38[ε] Marie-Edith Bissey, Mauro Carini, Guido Ortona, *ALEX3: a simulation program to compare electoral systems*

2003 n.37* Cinzia Di Novi, *Regolazione dei prezzi o razionamento: l'efficacia dei due sistemi di allocazione nella fornitura di risorse scarse a coloro che ne hanno maggiore necessita'*

2003 n. 36* Marilena Localtelli, Roberto Zanola, *The Market for Picasso Prints: An Hybrid Model Approach*

2003 n. 35* Marcello Montefiori, *Hotelling competition on quality in the health care market.*

2003 n. 34* Michela Gobbi, *A Viable Alternative: the Scandinavian Model of "Social Democracy"*

2002 n. 33* Mario Ferrero, *Radicalization as a reaction to failure: an economic model of islamic extremism*

2002 n. 32[ε] Guido Ortona, *Choosing the electoral system – why not simply the best one?*

2002 n. 31** Silvano Belligni, Francesco Ingravalle, Guido Ortona, Pasquale Pasquino, Michel Senellart, *Trasformazioni della politica. Contributi al seminario di Teoria politica*

2002 n. 30* *Franco Amisano, La corruzione amministrativa in una burocrazia di tipo concorrenziale: modelli di analisi economica.*

2002 n. 29* Marcello Montefiori, *Libertà di scelta e contratti prospettici: l'asimmetria informativa nel mercato delle cure sanitarie ospedaliere*

2002 n. 28* Daniele Bondonio, *Evaluating the Employment Impact of Business Incentive* Programs in EU Disadvantaged Areas. A case from Northern Italy

2002 n. 27** Corrado Malandrino, *Oltre il compromesso del Lussemburgo verso l'Europa federale. Walter Hallstein e la crisi della "sedia vuota"(1965-66)*

2002 n. 26** Guido Franzinetti, *Le Elezioni Galiziane al Reichsrat di Vienna, 1907-1911*

2002 n. 25[ε] Marie-Edith Bissey and Guido Ortona, *A simulative frame to study the integration of defectors in a cooperative setting*

2001 n. 24* Ferruccio Ponzano, *Efficiency wages and endogenous supervision technology*

2001 n. 23* Alberto Cassone and Carla Marchese, *Should the death tax die? And should it leave an inheritance?*

2001 n. 22* Carla Marchese and Fabio Privileggi, *Who participates in tax amnesties? Self-selection of risk-averse taxpayers*

2001 n. 21* Claudia Canegallo, *Una valutazione delle carriere dei giovani lavoratori atipici: la fedeltà aziendale premia?*

2001 n. 20* Stefania Ottone, *L'altruismo: atteggiamento irrazionale, strategia vincente o amore per il prossimo?*

2001 n. 19* Stefania Ravazzi, *La lettura contemporanea del cosiddetto dibattito fra Hobbes e Hume*

2001 n. 18* Alberto Cassone e Carla Marchese, *Einaudi e i servizi pubblici, ovvero come contrastare i monopolisti predoni e la burocrazia corrotta*

2001 n. 17* Daniele Bondonio, *Evaluating Decentralized Policies: How to Compare the Performance of Economic Development Programs across Different Regions or*

*States*.

2000 n. 16* Guido Ortona**,** *On the Xenophobia of non-discriminated Ethnic Minorities*

2000 n. 15* Marilena Locatelli-Biey and Roberto Zanola**,** *The Market for Sculptures: An Adjacent Year Regression Index*

2000 n. 14* Daniele Bondonio**,** *Metodi per la valutazione degli aiuti alle imprse con specifico target territoriale*

2000 n. 13* Roberto Zanola, *Public goods versus publicly provided private goods in a two-class economy*

2000 n. 12** Gabriella Silvestrini, *Il concetto di «governo della legge» nella tradizione repubblicana.*

2000 n. 11** Silvano Belligni, *Magistrati e politici nella crisi italiana. Democrazia dei guardiani e neopopulismo*

2000 n. 10* Rosella Levaggi and Roberto Zanola, *The Flypaper Effect: Evidence from the Italian National Health System*

1999 n. 9* Mario Ferrero, *A model of the political enterprise*

1999 n. 8* Claudia Canegallo, *Funzionamento del mercato del lavoro in presenza di informazione asimmetrica*

1999 n. 7** Silvano Belligni, *Corruzione, malcostume amministrativo e strategie etiche. Il ruolo dei codici*.

1999 n. 6* Carla Marchese and Fabio Privileggi, *Taxpayers Attitudes Towaer Risk and Amnesty Partecipation: Economic Analysis and Evidence for the Italian Case.*

1999 n. 5* Luigi Montrucchio and Fabio Privileggi, *On Fragility of Bubbles in Equilibrium Asset Pricing Models of Lucas-Type*

1999 n. 4** Guido Ortona, *A weighted-voting electoral system that performs quite well.*

1999 n. 3* Mario Poma, *Benefici economici e ambientali dei diritti di inquinamento: il caso della riduzione dell'acido cromico dai reflui industriali.*

1999 n. 2* Guido Ortona, *Una politica di emergenza contro la disoccupazione semplice, efficace equasi efficiente.*

1998 n. 1* Fabio Privileggi, Carla Marchese and Alberto Cassone, *Risk Attitudes and the Shift of Liability from the Principal to the Agent*

## Department of Public Policy and Public Choice *"Polis"*

The Department develops and encourages research in fields such as:

- theory of individual and collective choice;
- economic approaches to political systems;
- theory of public policy;
- public policy analysis (with reference to environment, health care, work, family, culture, etc.);
- experiments in economics and the social sciences;
- quantitative methods applied to economics and the social sciences;
- game theory;
- studies on social attitudes and preferences;
- political philosophy and political theory;
- history of political thought.

The Department has regular members and off-site collaborators from other private or public organizations.

# Instructions to Authors

**Please ensure that the final version of your manuscript conforms to the requirements listed below:**

The manuscript should be typewritten single-faced and double-spaced with wide margins.

Include an abstract of no more than 100 words.

Classify your article according to the *Journal of Economic Literature* classification system.

Keep footnotes to a minimum and number them consecutively throughout the manuscript with superscript Arabic numerals. Acknowledgements and information on grants received can be given in a first footnote (indicated by an asterisk, not included in the consecutive numbering).

Ensure that references to publications appearing in the text are given as follows:
COASE (1992a; 1992b, ch. 4) has also criticized this bias....
and
"...the market has an even more shadowy role than the firm" (COASE 1988, 7).

List the complete references alphabetically as follows:

**Periodicals:**
KLEIN, B. (1980), "Transaction Cost Determinants of 'Unfair' Contractual Arrangements," *American Economic Review*, 70(2), 356-362.
KLEIN, B., R. G. CRAWFORD and A. A. ALCHIAN (1978), "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process," *Journal of Law and Economics*, 21(2), 297-326.

**Monographs:**
NELSON, R. R. and S. G. WINTER (1982), *An Evolutionary Theory of Economic Change*, 2nd ed., Harvard University Press: Cambridge, MA.

**Contributions to collective works:**
STIGLITZ, J. E. (1989), "Imperfect Information in the Product Market," pp. 769-847, in R. SCHMALENSEE and R. D. WILLIG (eds.), *Handbook of Industrial Organization,* Vol. I, North Holland: Amsterdam-London-New York-Tokyo.

**Working papers:**
WILLIAMSON, O. E. (1993), "Redistribution and Efficiency: The Remediableness Standard," Working paper, Center for the Study of Law and Society, University of California, Berkeley.